Geologic Resources Inventory Workshop Summary
Southeast Utah Group National Park, Utah
May 24-27, 1999

National Park Service
Geologic Resources Division
and
Natural Resources Information Division

Version: Draft of June 8, 1999

EXECUTIVE SUMMARY

An inventory workshop was held for national park service units in the Southeast Utah Group (Arches NP, Canyonlands NP, Hovenweep NM, and Natural Bridges NM) from May 24-27, 1999 to view and discuss the geologic resources, to address the status of geologic mapping by the Utah Geological Survey (UGS) for compiling both paper and digital maps, and to assess resource management issues and needs. Cooperators from the NPS Geologic Resources Division (GRD), Natural Resources Information Division (NRID), Southeast Utah Group NPS staff (interpretation, natural resources, deputy superintendents), UGS, United States Geological Survey (USGS), and Utah Geological Association (UGA) were present for the two day workshop. (***See Appendix A, Southeast Utah Group Geological Resources Inventory Workshop Participants, May 24-27, 1999***)

Monday May 24th involved a field trip to Natural Bridges NM (nabr) led by Red Rocks College geologist Jack Stanesco with additions from Christine Turner and Pete Peterson (both of the USGS).

Tuesday May 25th involved a field trip to Canyonlands NP (cany) led by USGS geologist George Billingsley, again with additions from Christine Turner and Pete Peterson also of the USGS.

Wednesday May 26th involved a field trip to Arches NP (arch) led by UGS geologist Hellmut Doelling with additions from Grant Willis (UGS) and Vince Santucci (NPS-GRD).

An on-line slide show of the highlights of these field trips can be found at http://www.nature.nps.gov/grd/geology/gri/ut/seug/field_trip_seug

Thursday May 27th involved a scoping session to present overviews of the NPS Inventory and Monitoring (I&M) program, the Geologic Resources Division, and the ongoing Geologic Resources Inventory (GRI) for Colorado and Utah. Round table discussions involving geologic issues for the Southeast Utah Group included interpretation, the UGA Millennium 2000 guidebook featuring the geology of Utah's

National and State parks, paleontological resources, the status of cooperative geologic mapping efforts, sources of available data, geologic hazards, potential future research topics, and action items generated from this meeting. Brief summaries of each follows.

OVERVIEW OF GEOLOGIC RESOURCES INVENTORY

After introductions by the participants, Joe Gregson (NPS-NRID) presented an overview of the NPS I&M Program, the status of the natural resource inventories, and the geological resources inventory (***see Appendix B, Overview of Geologic Resources Inventory***).

He also presented a demonstration of some of the main features of the **digital geologic map** for the Black Canyon of the Gunnison NM and Curecanti NRA areas in Colorado. This has become the prototype for the NPS digital geologic map model as it ideally reproduces all aspects of a paper map (i.e. it incorporates the map notes, cross sections, legend etc.) with the added benefit of being a GIS component. It is displayed in ESRI ArcView shape files and features a built-in help file system to identify the map units. It can also display scanned JPG or GIF images of the geologic cross sections supplied with the map. The cross section lines (ex. A-A') are subsequently digitized as a shape file and are hyperlinked to the scanned images.

For a recap on this process, go to: http://www.nature.nps.gov/grd/geology/gri/blca_cure/ ***and view the various files in the directory.***

The geologists at the workshop familiar with GIS methods were quite impressed with this method of displaying geologic maps digitally; Gregson is to be commended for his accomplishments.

Bruce Heise (NPS-GRD) followed with an introduction to the NPS GRD group.

INTERPRETATION

The GRI also aims to help promote geologic resource interpretation within the parks and GRD has staff and technology to assist in preparation of useful materials including developing site bulletins and resource management proposal (RMP) statements appropriate to promoting geology. Jim Wood (GRD) and Melanie Moreno (USGS-Menlo Park, CA) have worked with several other NPS units in developing web-based geology interpretation themes, and should be considered as a source of assistance should the park desire.

Along the lines of interpretation of geology for the SEUG, it was suggested that they consider hiring a full-time geologist to be on staff to evaluate research proposals and generally assist all interpretive areas within the SEUG to find out what issues should be addressed. A geologist could add greatly to NABR, CANY, and ARCH because the primary theme of these parks is geologic; there would be no bridges, arches, or canyon (lands) without the underlying influence of geology and geologic processes upon this part of the world. A geologist would also certainly be active in establishing the most effective wayside exhibits aimed at informing the public about the geologic wonders of the area. A geologist can certainly assist in the presentation and interpretation of paleontologic resources and issues also.

Such a position could act as a liaison among various tour groups, researchers, field camps and professional organizations that visit the area because of the spectacular geology. Geologic hazards would also be able to be more fully understood. Obviously, effective communication skills are a highly desirable quality for any applicant.

In the absence of such a position, the GRD is most willing to assist the SEUG in any geologic matters and issues should they desire. Please contact Bruce Heise or Tim Connors to discuss further matters regarding geologic resources.

UGA GUIDEBOOK ON UTAH'S NATIONAL AND STATE PARK AREAS

Doug Sprinkel of the UGA announced that a guidebook treating the geology of 27 of Utah's national and state parks and monuments will be compiled for publication in September 2000. This compilation will be a snapshot into the geology of each park and covers most facets of what the GRI is trying to develop for each park for a final report (i.e. cross sections, simplified geologic map, general discussions of rocks, structure, unique aspects of park geology, classic viewing localities). Each author will be *encouraged* to get with NPS staff interpreters to develop a product that aims at a wide audience (the common visitor, the technical audience and the teaching community). Authors for SEUG parks are as follows:

- Arches NP: Hellmut Doelling (UGS)
- Canyonlands NP: Donald Baars
- Natural Bridges NM: Jackie Huntoon, Russell Dubiel, Jack Stanesco

Also, a CD-ROM will be distributed with the publication featuring road and trail logs for specific parks as well as a photo glossary and gallery. Park authors are strongly encouraged to get with NPS staff to make sure that any trail logs do follow maintained trails and do not take visitors into unauthorized areas, or places where resources are fragile and would be disturbed by increased visitation (i.e. areas with crytptogamic soils).

The photo glossary will describe certain geologic features (i.e. what is crossbedding?). These will also be available as web-downloadable Adobe Acrobat PDF files. The UGA cannot copyright this material because it is funded with state money, so it can be distributed widely and freely, which will also benefit the purposes of the GRI. Additional reprints are not a problem because of the digital nature of the publication and the UGA board is committed to additional printings as needed. UGA normally prints 1000 copies of their publications because they become dated after about five years; that will probably not be an issue for this publication. Prices for the full-color guidebook are estimated to be approximately $25/copy, and sales are expected to be high (exact estimates for Capitol Reef NM were 125 copies/year). A website for the guidebook is forthcoming in October 1999.

Field Trips will be held in September 2000. Currently, four field trips are scheduled:

1. Arches NP, Canyonlands NP, Dead Horse Point State Park (SP)
2. Antelope Island SP and Wasatch Mountain SP

3. Southeast Utah Group NP, Cedar Breaks NM, Snow Canyon SP and Quail Creek SP
4. Dinosaur NM, Flaming Gorge NRA, and Red Fleet SP

Note: Trips 1 and 2 will run concurrently and Trips 3 and 4 will also run concurrently.

Many other benefits are anticipated from this publication and are enumerated below:

- This type of project could serve as a model for other states to follow to bolster tourism and book sales promoting their state and its geologic features.

- Sandy Eldredge (UGS) will be targeting teaching communities for involvement in the field trips; hopefully teachers will pass on what they have learned to their young audience.

- The language is intended to appeal to someone with a moderate background in geology and yet will be very informative to the educated geologist.

- The publication may be able to serve as a textbook to colleges teaching Geology of National Parks (in Utah).

- A welcomed by-product could be roadlogs between parks in Utah for those visiting multiple parks, perhaps with a regional synthesis summarizing how the overall picture of Utah geology has developed.

DISTURBED LANDS

GRD's John Burghardt has done work in Lathrop Canyon on reclaiming abandoned mineral lands (aml). His reports should be studied as a significant source of data for this area to determine if additional work needs to be performed. Dave Steensen (GRD) heads the AML program and can also be contacted.

PALEONTOLOGICAL RESOURCES

The field trip at Arches NP provided glimpses into the paleontological resources (dinosaur bones) near Delicate Arch. It has been suggested to keep this location low profile to minimize disturbances and potential theft or vandalism.

During the scoping session, the importance of a paleontological resource inventory for the Cedar Mountain and Morrison Formations near the Dalton Wells Quarry was discussed as being a priority. The important resources are likely to be dinosaur bones. A staff geologist or paleontologist would surely be useful for this purpose

Vince Santucci (NPS-GRD Paleontologist) will be co-authoring a "*Paleontological Survey of Arches National Park*" and detailing findings of resources within the park. Plants, invertebrates, and vertebrate tracksites are among the recognized paleontological resources within the Southeast Utah Group area parks.

Similar surveys have been done for Yellowstone and Death Valley NP's and have shed valuable new information on previously unrecognized resources. These surveys involve a literature review/bibliography and recognition of type specimens, species lists, and maps (which are unpublished to protect locality information), and also make park specific recommendations for protecting and preserving the resources.

The Death Valley Survey will be available soon. The **Yellowstone** Survey is already available on-line at:
http://www.nature.nps.gov/grd/geology/paleo/yell_survey/index.htm

and is also available as a downloadable PDF at
http://www.nature.nps.gov/grd/geology/paleo/yell.pdf

Paleontological resource management plans should be produced for Southeast Utah Group involving some inventory and monitoring to identify human and natural threats to these resources. Perhaps someone on the park staff could be assigned to coordinate paleontological resource management and incorporate any findings or suggestions into the parks general management plan (GMP). It would be useful to train park staff (including interpreters and law enforcement) in resource protection, as the fossil trade "black market" has become quite lucrative for sellers and often results in illegal collecting from federal lands.

Collections taken from this area that now reside in outside repositories should be tracked down for inventory purposes. Fossils offer many interpretive themes and combine a geology/biology link and should be utilized as much as possible in interpretive programs.

STATUS OF GEOLOGIC MAPPING EFFORTS FOR THE SEUG

Status of Existing Maps

It should be noted that the following paper geologic maps exist:

- Arches NP ("*Geologic Map of Arches National Park and vicinity, Grand County, Utah*" by Hellmut H. Doelling, 1985) at *1:50,000.* The area was mapped at *1:24,000* scale, but compiled at *1:50,000* scale.

- Canyonlands NP ("*Geologic Map of Canyonlands National Park and Vicinity, Utah*" by George Billingsley, Peter Huntoon, and William J. Breed, 1982) at *1:62,500*

- Canyonlands NP *("Bedrock Geologic Map of Upheaval Dome, Canyonlands NP, Utah"* by Gene Shoemaker, Herkenhoff and Kriens, 1997); scale unknown.

George Billingsley noted that when he worked on the Canyonlands map, he mostly compiled previous material. He thought several additions to the Quaternary deposits and the placement of joints/fractures on the maps would improve the quality of the 1982 Canyonlands map. There are also some issues regarding assignment of the Page Sandstone, and the controversy of the Dewey Bridge Member of the Entrada versus the Carmel Formation being within the map area. He thinks eventually, the entire area

should be compiled at *1:24,000* to better enhance features and add to resource management.

Jackie Huntoon has told Bruce Heise that she is working on a digital coverage for Natural Bridges, but needs the hypsography (contour lines) to complete her work. Desired quadrangles that NRID has this coverage for are the following:

- The Cheesebox
- Woodenshoe Buttes
- Kane Gulch
- It is not sure if the coverage exists for the Moss Back Butte quadrangle; Joe Gregson will look into it.

Digitized Maps

The 1985 Arches map has been digitized into an ArcInfo coverage by SEUG staff. The attribute quality is unknown however, and will be researched. NPS-GRI folks will work with SEUG GIS Specialist Gery Wakefield to learn more about this coverage

The 1982 Canyonlands map is not known to have been digitized at this point and hopefully can be done by the SEUG GIS staff. **George Billingsley** says that the Canyonlands Natural History Association has the original line work and mylars; **Diane Allen** said she will contact them to see if they still have this work.

The 1997 Upheaval Dome map is digitized as an ArcInfo coverage and a copy was given to Craig Hauke (cany) from George Billingsley. It also contains cross sections and a report. A website exists for this work at: http://www.seismo.unr.edu/ftp/pub/louie/dome/98seismo/index.html.

UGS Mapping Activities in SEUG area

Currently, the UGS is mapping in Utah at three different scales:

- ***1:24,000*** for high priority areas (i.e. National and State parks)
- ***1:100,000*** for the rest of the state
- ***1:500,000*** for a compiled state geologic map

The UGS plans to complete mapping for the entire state of Utah within 10-15 years at *1:100,000* scale. For ***1:100,000*** scale maps, their goal is to produce *both* paper and digital maps; for ***1:24,000*** scale maps, the only digital products will be from "special interest" areas (i.e. areas such as Southeast Utah Group and growing metropolitan St. George). Grant Willis mentioned that the UGS simply does not have enough manpower and resources to do more areas at this scale. He also reiterated that UGS mapping goals are coincident with those of the National Geologic Mapping Program.

Grant Willis talked about the status of UGS mapping activities within the Southeast Utah Group area (***see Appendix C for reviewing specific index maps for each park)***.

30 x 60 sheets (at *1:100,000*) for the area include the **La Sal** (greater Canyonlands area) and **Moab** (Arches NP) sheets, which are currently in progress (paper and digital format).

Below is a brief summary of various mapping projects for SEUG parks from the UGS:

Park	Quadrangle	Status
Arches NP	Klondike Bluffs	UGS (Doelling) mapping in Progress
	Mollie Hogans	UGS (Doelling) mapping in Progress
	Cisco SW	Slated for future work
	Big Bend	Paper map published 1998; not digitized
	The Windows Section	UGS (Doelling) mapping in Progress
	Merrimac Butte	In publication
	Gold Bar Canyon	Published
	Moab-16	Ready for press
	Moab (30x60)	Digital and printed map in progress
Canyonlands NP	Hanksville	Nothing currently; hopefully in a few years
	La Sal	Digital and printed map in progress
Natural Bridges NM	Hite Crossing	Nothing slated at this time
	Blanding	

OTHER SOURCES OF NATURAL RESOURCES DATA FOR SEUG

- The UGS has a significant quadrangle database that they have furnished to NRID for the entire state of Utah.

- NRID has compiled a geologic bibliography for numerous parks and monuments, including all parks in the Southeast Utah Group. Visit the website at: http://165.83.36.151/biblios/geobib.nsf; user id is "geobib read", password is "anybody".

- SEUG GIS specialist showed a digitized version of Hellmut Doelling's 1985 map as and ArcInfo coverage; attribution needs to be checked; other coverage's should be sought that may exist from the previous GIS specialist

- GRD has several entries regarding abandoned mineral land (AML) sites in their database that should be checked for data validity and compared with park records; John Burghardt (GRD) should be contacted regarding this

- The Arches NP visitor center sells a publication that has an inventory of all the arches of Arches

- The UGS has compiled a CD-ROM with well locations, pipelines, etc. for the state of Utah; GRD should obtain a copy of this. Parks may also desire copies too.

GEOLOGIC HAZARDS

There are numerous issues related to geologic hazards in and around the Southeast Utah Group parks. Below is a brief list of some mentioned during the scoping session:

- Landslide and rockfall potential along all roads that occasionally cause road closures; of special note was the problem with the main road in Arches, just above the visitor center
- Landscape Arch (arch) collapsed in a few places several years ago and was recorded by a tourist
- Swelling soils associated with bentonitic shale's of the Chinle, Morrison, and Mancos formations
- Radon potential associated with mine closures
- Earthquake potential along the Moab Fault

POTENTIAL RESEARCH TOPICS FOR SOUTHEAST UTAH GROUP NP

A list of potential research topics includes studies of the following:

- What are the connections between gypsiferous rocks and cryptobiotic soils/crusts?; why were the crust healthier on the gypsum-bearing rocks?
- How long will Delicate Arch stand?
- Engineering studies to determine hazards to visitors; use strain meter
- Use High resolution GPS to detect moving, swelling, and collapse in areas of the parks
- Rock color studies
- Subsurface seismic work for voids in the Needles around synclines and salt dome structures
- Locate real unconformity between Entrada Moab Tongue and abutting formations

ACTION ITEMS

Many follow-up items were discussed during the course of the scoping session and are reiterated by category for quick reference.

Interpretation

- More graphics and brochures emphasizing geology and targeting the average enthusiast should be developed. If Southeast Utah Group NP needs assistance with

these, please consult GRD's Jim Wood (jim_f._wood@nps.gov) or Melanie Moreno at the USGS-Menlo Park, CA (mmoreno@usgs.gov).

- Consider the possibility of hiring a full-time geologist to handle geologic issues for the SEUG; in the absence of this consult with GRD for assistance in geologic matters

UGA Guidebook

- Attempt to plant the seeds of this concept to other states for similar publications involving local area geology. Such publications are especially useful for the GRI

- Have authors prepare logs that are "sensitive" to delicate areas in the park (i.e. where less user impact is desired)

Paleontological Resources

- For now, try to minimize location disclosure of vertebrate sites to minimize disturbances and the potential for theft or vandalism

- Develop an in-house plan to inventory, monitor and protect significant paleontological resources from threats; assign staff to oversee especially in regard to the Dalton Wells area

- Locate collections taken from the park residing in outside repositories

Geologic Mapping

- Attempt to complete digital coverage for the entire SEUG area from existing maps
- Locate already existing digital coverage's (like that of Doelling's 1985 Arches map)
- Work closely with UGS to finish paper and digital coverage of SEUG area where maps are lacking
- Work with cooperators (NABR-Jackie Huntoon) to ensure there work could be incorporated into the master plan of the GRI

Natural Resource Data Sources

- Examine GRD databases for AML and disturbed lands for data validity

- Attempt to locate other digital coverage's from the previous SEUG GIS specialist (Eric) for Gery Wakefield's (current SEUG GIS specialist) inventory

Miscellaneous

- Review proposed research topics for future studies within Southeast Utah Group NP

- Promote sensitivity to delicate resources (crusts, etc.) to researchers, and visiting park groups

APPENDIX A
Southeast Utah Group NP Geological Resources Inventory Workshop Participants *May 24-27, 1999*

NAME	*AFFILIATION*	*PHONE*	*E-MAIL*	Nabr	Cany	Arch	scope
Joe Gregson	NPS, Natural Resources Information Division	(970) 225-3559	Joe_Gregson@nps.gov	X	X	X	X
Tim Connors	NPS, Geologic Resources Division	(303) 969-2093	Tim_Connors@nps.gov	X	X	X	X
Bruce Heise	NPS, Geologic Resources Division	(303) 969-2017	Bruce_Heise@nps.gov	X	X	X	X
Christine Turner	USGS	(303) 236-1561	Cturner@usgs.gov	X	X		
Fred Peterson	USGS	(303) 236-1546	Fpeterson@usgs.gov	X	X		
Jack Stanesco	Red Rocks CC	(303) 914-6290	Jack.Stanesco@rrcc.cccoes.edu	X	X		
Craig Hauke	NPS, CANY	(435) 259-3911 ext. 2132	Craig_hauke@nps.gov	X	X	X	X
Grant Willis	Utah Geological Survey	(801) 537-3355	Nrugs.gwillis@state.ut.us	X	X	X	X
George Billingsley	USGS-Flagstaff, AZ	(520) 556-7198	Gbillingsley@usgs.gov		X		X
Vince Santucci	NPS, Geologic Resources Division	(307) 877-4455	Vince_Santucci@nps.gov		X	X	X
Jim Dougan	NPS, NABR	(435) 692-1234	Jim_Dougan@nps.gov	X			
Al Echevarria	Red Rocks CC	(303) 985-5996	Ale44@juno.com	X			
Dave Wood	NPS, CANY	(435) 259-3911 ext. 2133	Dave_Wood@nps.gov		X		X
Traci Kolc	NPS, CANY	(435) 259-4712 ext. 18	Traci_Kolc@nps.gov		X		
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NAME	*AFFILIATION*	*PHONE*	*E-MAIL*	Nabr	Cany	Arch	scope
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Shawn Duffy	NPS, ARCH	(435) 259-7223	Shawn_Duffy@nps.gov			X	
Murray Shoemaker	NPS, ARCH	(435) 259-8161 ext. 244	Murray_Shoemaker@nps.gov			X	
Helmut Doelling	UGS	(435) 835-3652	None			X	
Doug Sprinkel	UGS / UGA	(801) 782-3398	Sprinkel@vii.com			X	X
Jim Webster	NPS, ARCH	(435) 259-8161 ext. 220	Jim_Webster@nps.gov				X
Gery Wakefield	NPS, SEUG GIS coordinator	(435) 259-3911 ext. 2180	Gery_Wakefield@nps.gov				X
Phil Brueck	NPS, SEUG	(435) 259-3911 ext. 2102	Phil_Brueck@nps.gov				X
Bruce Rodgers	NPS, SEUG	(435) 259-3911 ext. 2130	Bruce_Rodgers@nps.gov				X
Diane Allen	NPS, ARCH	(435) 259-8161	Diane_Allen@nps.gov				X
Paul Henderson	NPS, SEUG	(435) 259-3911 ext. 2140	Paul_Henderson@nps.gov				X

APPENDIX B
Overview of Geologic Resources Inventory

The NPS Geologic Inventory is a collaborative effort of the NPS Geologic Resources Division (GRD) and Inventory and Monitoring Program (I&M) with assistance from the U.S. Geological Survey (USGS), American Association of State Geologists (AASG), and numerous individual volunteers and cooperators at NPS units, colleges, and universities.

From the perspective of the servicewide I&M Program, the primary focus (Level 1) of the geological inventory is

1. to assemble a bibliography of associated geological resources for NPS units with significant natural resources,

2. to compile and evaluate a list of existing geologic maps for each unit,

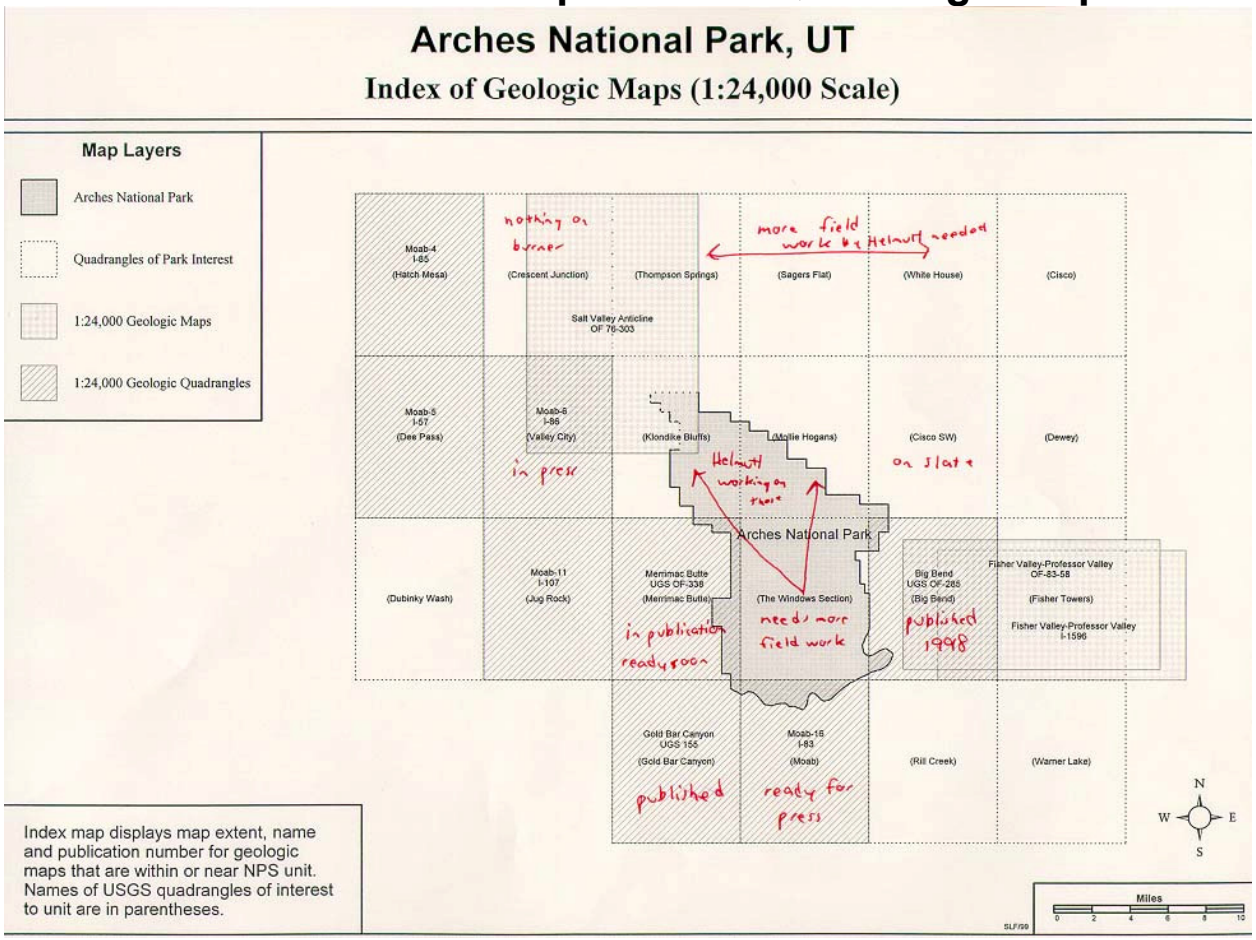
3. to develop digital geologic map products, and

4. to complete a geological report that synthesizes much of the existing geologic knowledge about each park. The emphasis of the inventory is not to routinely initiate new geologic mapping projects, but to aggregate existing information and identify where serious geologic data needs and issues exist in the National Park System.

The NPS Geologic Resources Division is an active participant in the I&M Program and has provided guidance and funding in the development of inventory goals and activities. GRD administers the Abandoned Mine Lands (AML) and Geologists In Parks (GIP) programs which contribute to the inventory. NPS paleontologists, geologists, and other natural resource professionals also contribute to inventory planning and data. A major goal of the collaborative effort is to provide a broad baseline of geologic data and scientific support to assist park managers with earth resource issues that may arise.

For each NPS unit, a cooperative group of geologists and NPS personnel (the Park Team) will be assembled to advise and assist with the inventory. Park Teams will meet at the each NPS unit to discuss and scope the geologic resources and inventory, which is the subject of this report. If needed, a second meeting will be held at a central office to evaluate available geologic maps for digital production. After the two meetings, digital geologic map products and a geologic report will be produced. The report will summarize the geologic inventory activities and basic geology topics for each park unit. Due to the variety of geologic settings throughout the NPS, each report will vary in subject matter covered, and section topics will be adapted as needed to describe the geologic resources of each unit. Whenever possible the scientific sections of the report will be written by knowledgeable cooperators and peer reviewed for accuracy and validity.

APPENDIX C
Southeast Utah Group Index of Quadrangle Maps



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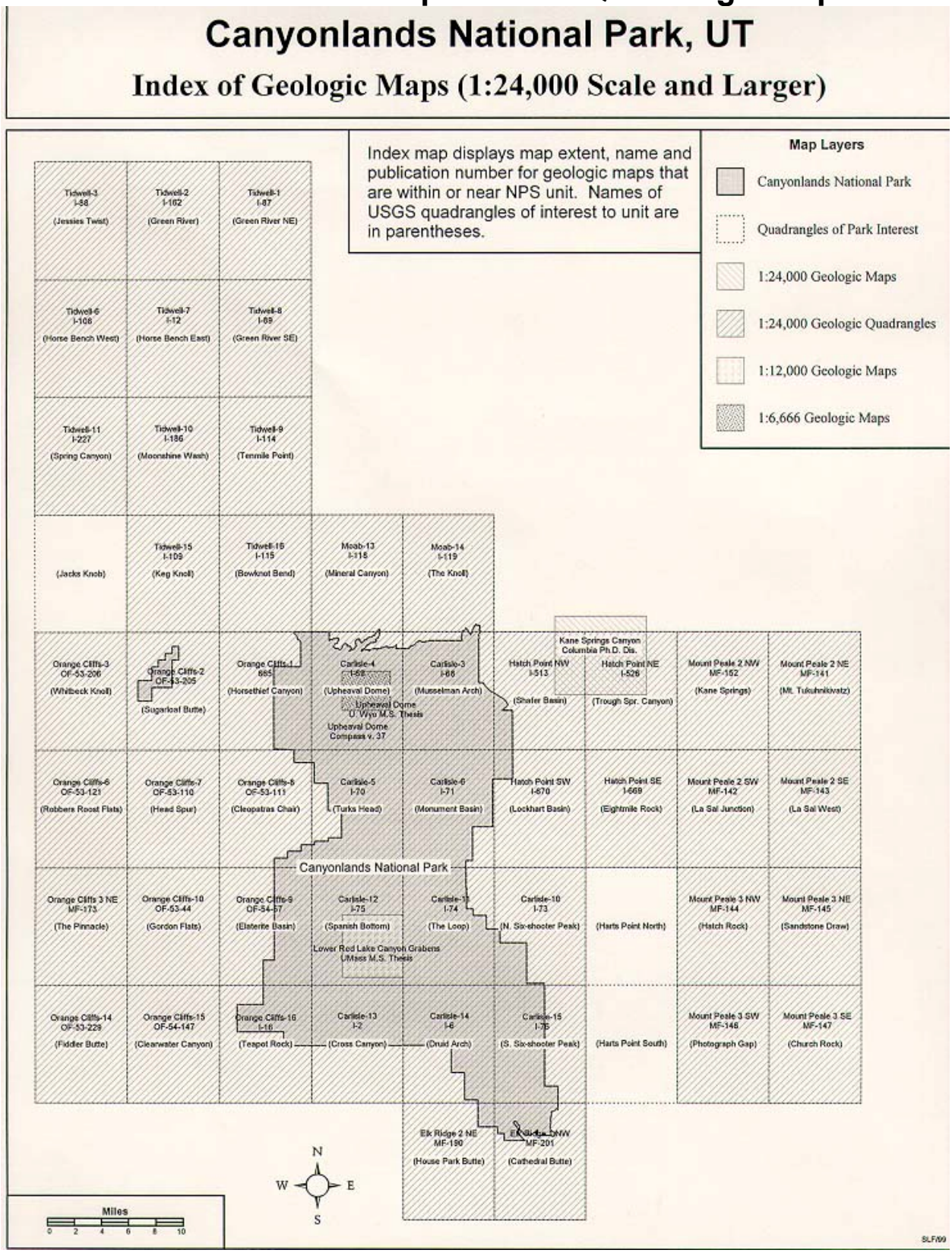

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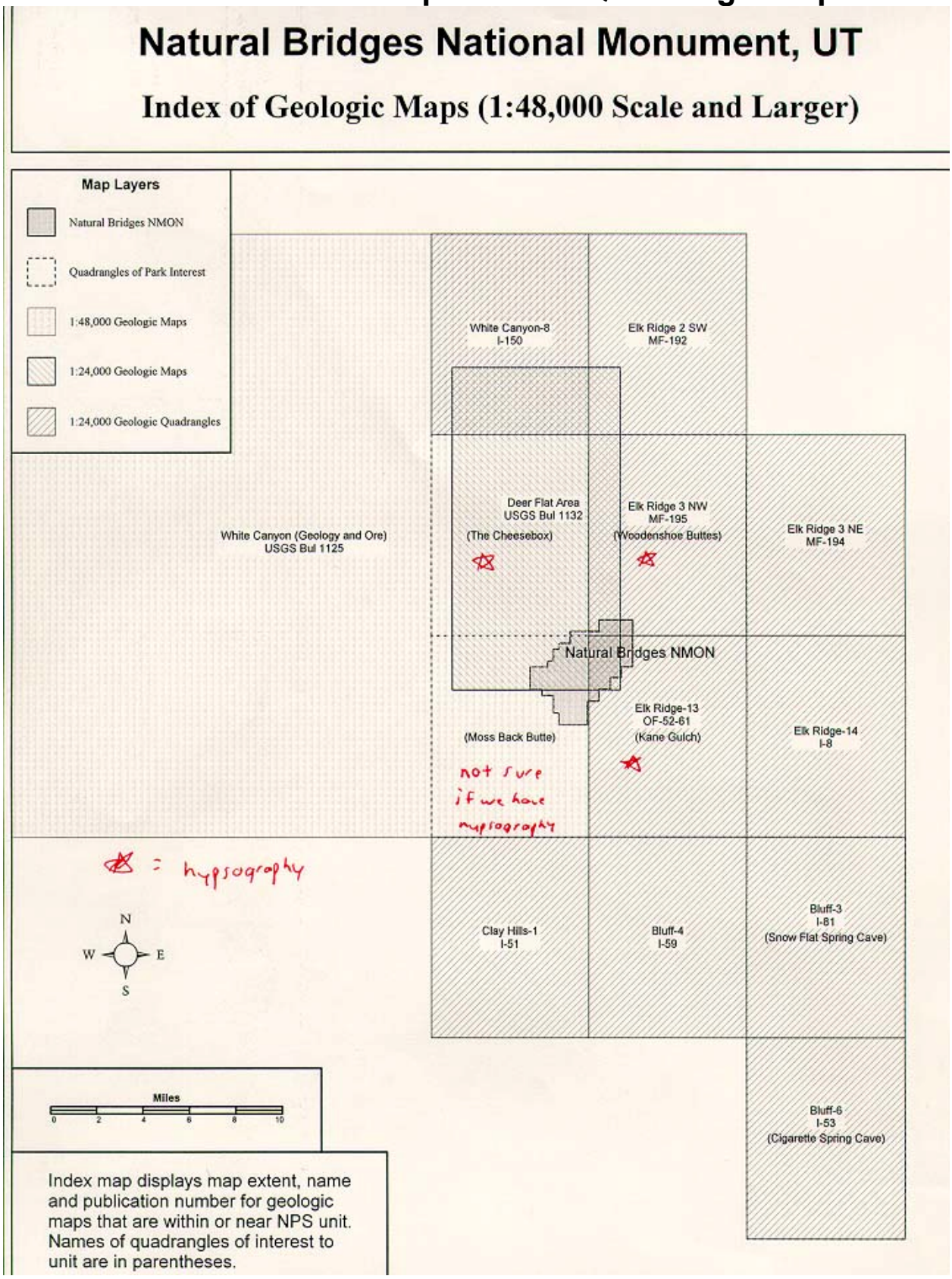

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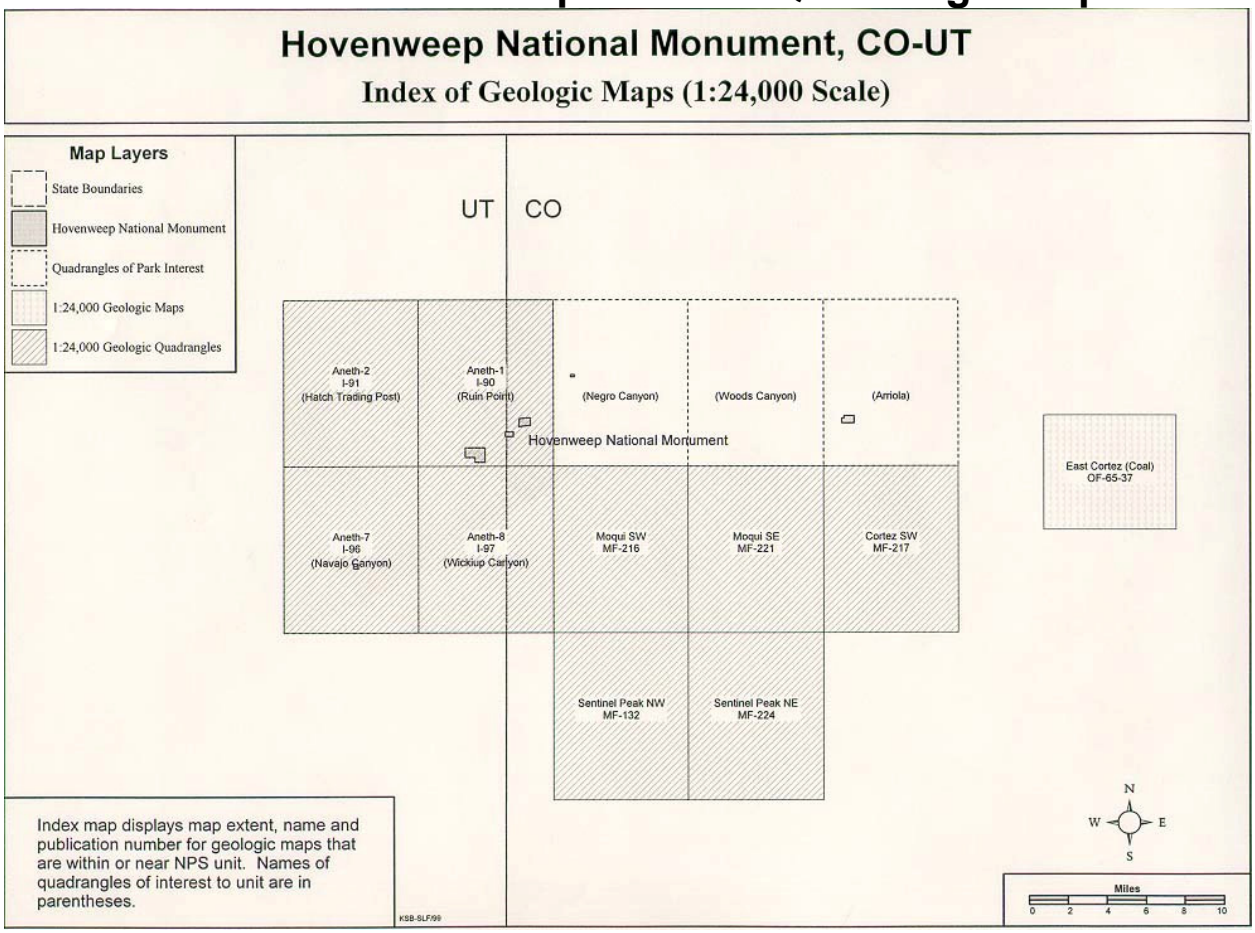

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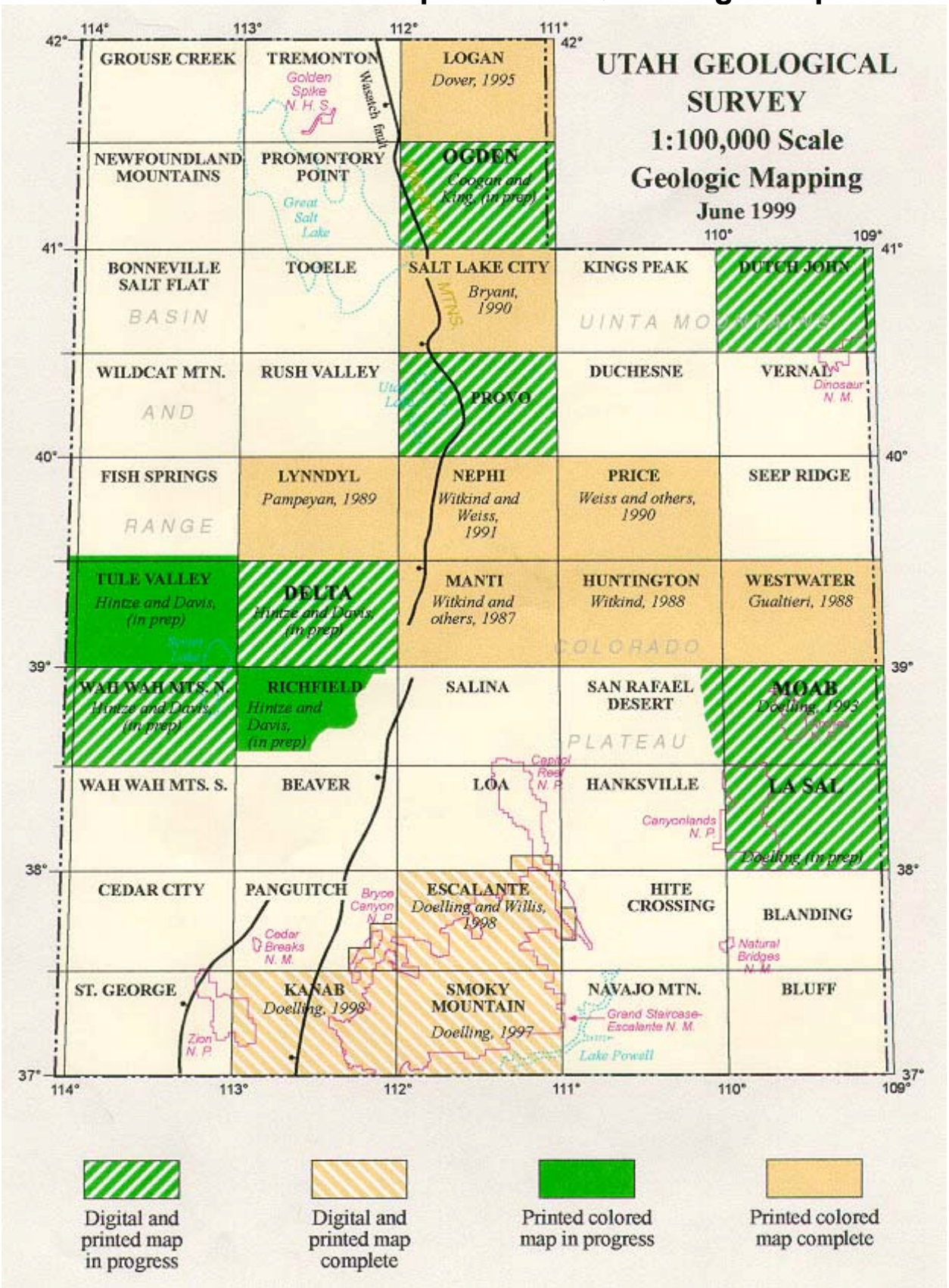

UGS Index Map